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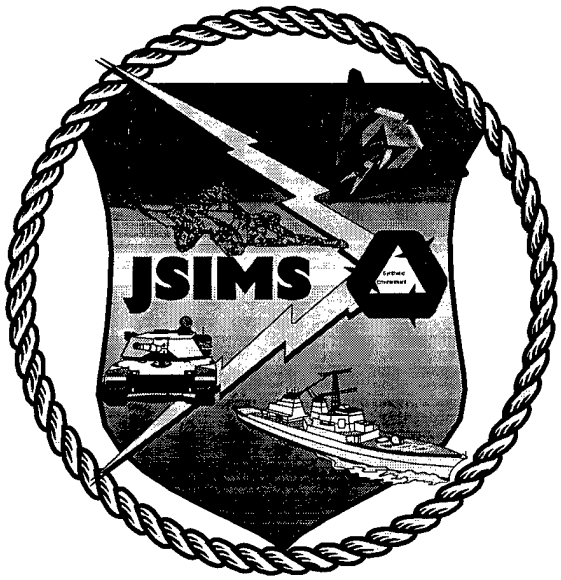
Joint Simulation System



Operational Requirements Document

Version 2.9

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1. General Description of Operational Capability

This Operational Requirements Document supports the Mission Needs Statement for the Joint Simulation System (JSIMS). The requirements described in this document follow criteria established by ***CJCSI 3500.01A, Joint Training Policy for the Armed Forces of the United States,*** 1 July 1997, regarding modeling and simulation (M&S) support to joint training. In accordance with that criteria, JSIMS shall be used by unified commands, other joint organizations, and the Services for the following activities: training, education, developing doctrine and tactics, formulating and assessing operational plans, and assessing warfighting situations. The Universal Joint Task List (UJTL) and accompanying Service Task Lists (STLs) provide the common language and reference system to communicate mission requirements among the above activities. A detailed discussion of how JSIMS will be used within the UJTL framework to support the Joint Training System (JTS) is found in ***The JSIMS Concept of Operations***. The requirements presented in this document, therefore, use language and concepts consistent with the UJTL and JTS.

During the course of JSIMS fielding, the integration and development (I&D) contractor will provide or arrange software support and maintenance. The I&D contractor must also develop and implement a plan for post-deployment software support and maintenance.

1.1 *Executive and Development Agents*

JSIMS will contain a core of common representations to meet the requirements of joint and Service training, run-time hardware, software infrastructure, and interfaces augmented by representations of air/space, land, and maritime warfare functions. These representations will be provided by executive agents (EAs) and development agents (DAs) from the Army, Air Force, and Naval Forces for each warfare domain (land, air/space, and maritime). In addition, EAs from the Defense Intelligence Agency (DIA), Defense Information Systems Agency (DISA), US Transportation Command (USTRANSCOM), and US Special Operations Command (USSOCOM) represent the functions of intelligence (US intelligence processes and foreign representation), C4, defense transportation system, and special operations, respectively. JSIMS representation of the physical environment (terrain, ocean, atmosphere and space) will be developed in coordination with the Under Secretary of Defense for Acquisition and Technology (USD -- A&T) - designated M&S EAs for these domains; National Imagery and Mapping Agency (NIMA), Oceanographer of the Navy, and the Air Force Combat Climatology Center (AFCCC), respectively.

1.2 *General Capabilities*

As discussed in the Secretary of Defense ***Annual Report to the President and the Congress,*** April 1997, the primary purpose of JSIMS is to support training and education of ready forces by providing realistic joint training across all phases of military operations for all types of missions. It will interface with command, control, communications, computers, and intelligence (C4I) functions and equipment in the field. It will also be high level architecture (HLA) compliant in order to support interoperability with other DOD simulations. JSIMS will provide flexible support for joint training across the force by using efficient, composable simulations tailored to the users' needs. JSIMS will consist of core objects and run-time infrastructure developed and

constructed to comply with HLA requirements. These composable objects, resident in specific land, maritime, air/space, and other functions domains, will interoperate in a joint synthetic battlespace (JSB) to create an operational environment that is coherent between the levels of war, synchronized between types of events, and realistic in the context of the specific joint training scenario. JSIMS must reduce training support requirements by reducing the number of personnel required to operate the system and control the simulation.

JSIMS will provide the core infrastructure and life cycle applications to support the effective design, planning, preparation, execution, and post execution assessment of training exercises and other use activities. JSIMS will facilitate scenario design, development, and execution by providing tools that systematically link scenario objectives, events, performance measures, and feedback. JSIMS will support implementation of all phases of the Joint Training System (JTS).

The JSIMS operational requirements and performance parameters described in this document are organized into the three key attributes stated in the report: tailorability, composability, and efficiency (an "other" category of attributes is added to cover miscellaneous requirements such as security and reliability).

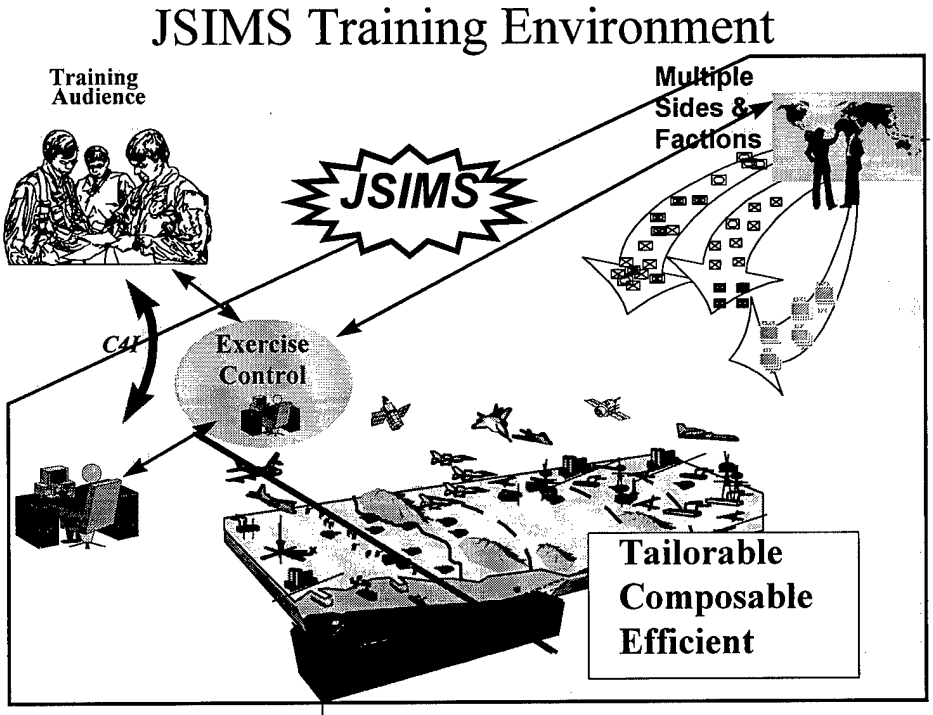

Figure 1.1 -- JSIMS Training Environment

1.2.1 Tailorability

Tailoring is the act of modifying the simulation. Tailorability refers to the characteristics of JSIMS objects and architecture that produce the operational flexibility needed by JSIMS to create a realistic training, education, or mission rehearsal environment for the unique requirements of each user. JSIMS must provide the using commander the capability to create a simulation environment to meet requirements derived from mission analysis using the UJTL and

appropriate STLs under the conditions and to the standards (measures and criteria) set by the commander. Chapter 4 further describes tailorability-related requirements as the ability to:

- Provide a JSB representing all warfare domains and applicable functions at a level of resolution appropriate for the training, educational, or mission rehearsal simulation event.
- Incorporate the effects of non-military factors on mission critical tasks.
- Provide the capability to support unique simulation environments to meet the needs of both the training audience and the exercise control group.
- Provide the capability to modify JSIMS objects so that new warfighting concepts or equipment can be simulated.

1.2.2 Composability

Composing is the act of bringing simulations or parts of simulations together to create an appropriate training, education, or mission rehearsal environment. Composability refers to the technical flexibility needed by JSIMS to construct that environment for the unique requirements of each user. JSIMS must provide the capability to link to other simulation resources and operate using all or a portion of the non-core components or domains. Chapter 4 further describes composability-related requirements as the ability to:

- Provide the capability to operate in a distributed mode to dispersed training audiences, with or without external support, as well as the ability to conduct smaller events in a stand-alone mode using organic resources.
- Provide the capability to access and manipulate information from other resources.
- Draw HLA compliant objects from various repositories to compose a joint synthetic battlespace (JSB) to support a specific training event or create a JSB within which another use application might be undertaken.

1.2.3 Efficiency

Efficiency refers to operational and technical responsiveness in presenting a training, education, or mission rehearsal environment. JSIMS must reduce the personnel and time required to provide a training, education, or mission rehearsal event. Chapter 4 further describes efficiency-related requirements as the need to:

- Incorporate tools and automated routines to facilitate responsive design, planning, and preparation processes for JSIMS events.
- Incorporate tools and automated routines to reduce the effort required to execute a JSIMS event and provide a relevant after action review (AAR).

1.3 *Phased Development from Initial to Final Operational Capability*

JSIMS capabilities will be developed in phases. At initial operational capability (IOC), JSIMS will, at a minimum, replace the useful training functionality of the 1998 Joint Training Confederation (JTC) as defined by the CINCs and Services, and be consistent with the common task list and under conditions contained in CJCSI 3500.02A, Joint Training Master Plan for the Armed Forces of the United States and to standards specified in the ***CJCSM 3500.05 Joint Task Force Headquarters Master Training Guide (JTF-HQ-MTG)***, 15 April 1997, and associated

subordinate MTGs, when developed, for functional component commanders. At (IOC), JSIMS will focus on support for training at the strategic-theater and operational levels of war for unified combatant command staffs, joint task force (JTF) commander and staff, and JTF component commanders and staffs. At IOC, JSIMS will present an accredited, interactive JSB to support joint and Service training.

At full operational capability (FOC), JSIMS will provide a comprehensive, verified and validated JSB that is suitable for accreditation activities, spanning strategic-national levels down to tactical levels. At FOC, JSIMS will support all warfare domains in all phases of operations (mobilization, deployment, employment, sustainment, and redeployment). The FOC version of JSIMS will also be suitable for supporting training and preparation for all tasks identified in the UJTL. By FOC, JSIMS will have evolved fully to support professional military and senior officer education, mission planning, mission rehearsal, and doctrine development. At maturity, JSIMS will allow globally dispersed forces, including deployed U.S. forces, R&D test facilities and ranges, defense educational institutions, reserve components, U.S. Government agencies, allies, and multinational forces to participate simultaneously in multi-echelon, simulation-assisted training events.

1.4 *Relationship of JSIMS to Other M&S Systems and Future Concept Efforts*

1.4.1 JSIMS and the Joint Warfare System (JWARS)

JSIMS development and use will complement JWARS, an analytical model. JWARS is being developed as a primary operations analysis tool, with a focus on operations analysis without humans-in-the-loop (HITLs). JSIMS, on the other hand, is focused primarily on training, but will possess the functionality to enable limited HITLs operational analysis. Some functions performed by JSIMS during joint exercises, such as course of action assessment, provide some degree of operational analysis, and the level of behavioral complexity required for some JSIMS uses is similar to that required for JWARS. In addition, JSIMS HITLs capability can provide expanded insights and improve the quality of overall operational analysis. Certain development activities, such as development of a common joint conceptual model of the mission space, will be pursued by the JWARS Office and the JSIMS Program Office in accordance with the provisions of the Memoranda of Agreement between the two organizations.

1.4.2 JSIMS and the Joint Modeling and Simulation System (JMASS)

JSIMS development and use will also complement JMASS, which supports the acquisition community. JMASS will incorporate a standard modeling architecture and simulation support environment (SSE) used in the development of digital models of threat and friendly systems. The primary JMASS focus will be on acquisition process support. JMASS will provide a similarly comprehensive level of modeling and simulation support to the acquisition community that JSIMS will provide to the training and operational community.

1.4.3 JSIMS and the Joint Conceptual Model of the Mission Space (JCMMS)

JCMMS will identify and describe the real-world joint mission space according to physical systems, processes, functions, and tasks relevant to unified action carried out by a joint force in its area of operations. JCMMS will use joint and Service doctrine and support object-oriented analysis and design. JCMMS provides authoritative descriptions of the joint mission space in

terms of the physical environment, systems, materiel, transportation, organization, doctrine, and human characteristics.

1.4.4 JSIMS, Joint Exercise Management Package (JEMP), and Service Exercise Management Packages

JEMP provides a framework and suite of computerized tools for more efficient, fully coordinated planning, preparation, and execution of joint exercises. Since the scope of JSIMS joint exercises will range from single site local training events to large, complex distributed exercises requiring careful scheduling of resources, the two systems must interact. Interaction is required to facilitate exercise planning and preparation through manipulation of data maintained by JEMP and to provide post-exercise feedback with respect to determination of future exercise support requirements.

1.4.5 JSIMS and Joint Vision 2010

Joint Vision 2010 (JV 2010) is the conceptual template for how America's Armed Forces will channel the vitality and innovation of our military resources to leverage technological opportunities to achieve new levels of effectiveness in warfighting. The vision has four operational concepts: dominant maneuver, precision engagement, full-dimensional protection, and focused logistics. Realization of the operational concepts relies on two key enablers, information superiority and technological innovation. JSIMS will be able to assist the JV 2010 effort by providing a synthetic environment for the exploration of JV 2010 key enablers and operational concepts. In light of anticipated JSIMS responsiveness to change and ability to portray future capabilities, it will also contribute substantially to the JV 2010 function of assessing the contribution of future military capabilities to those operational concepts.

2. Threat to JSIMS

This discussion of "threat" deals with the threats that potentially exist or will exist to the operation of JSIMS when the system is connected to real-world C4I systems.

The rapid development and increasing sophistication in information technologies and the resulting vulnerabilities for all C4I systems are factors that must be considered by JSIMS. Although the primary utility of JSIMS will be in the training environment, its connectivity to operational systems such as the Global Command and Control System (GCCS) and other intelligence systems (theater and national) could make JSIMS a potential target for information attack. Security precautions, such as physical procedures, encryption devices, and software safeguards, must be an integral part of the JSIMS design.

Threats to JSIMS include physical threats (i.e. sabotage, espionage, etc.), information collection threats (internal and external), data denial or manipulation threats (introduction of malicious codes or viruses), and reactive threats (identification of system capabilities or dependence could increase the possibilities of countermeasures). Connectivity to telecommunications networks in multiple distributed locations and the incorporation of commercial technologies also hold inherent threat implications for JSIMS. Additional information concerning these threats can be found in ***"Command, Control, Communications, Computers, and Intelligence (C4I) Systems and Networks; and Information Warfare Threats to Automated Information Systems Threat Environment Description (AIS TED) (U)," NAIC-1574-0210-97***, 17 April 1997.

3. Shortcomings of Existing Systems

With the existing US Armed Forces M&S systems, a robust, complete electronic representation of the full operational environment cannot be created without excessive overhead in personnel, time, and other resources. This is because current M&S systems do not possess the critical characteristics of tailorability, composability, and efficiency that will be designed into JSIMS to redress these shortfalls. Examples of tailorability, composability, and efficiency shortcomings in the existing systems are described below.

3.1 *Tailorability Shortcomings*

3.1.1 Functional Limitations

Existing models do not portray the full range of military operations. In addition, the existing M&S systems that replicate functions such as transportation, logistics, intelligence, space, and special operations do not interact with desired resolution and fidelity with combat models. An additional functional limitation of existing M&S systems is a failure to address the full range of military operations other than war (MOOTW). Addressing these shortfalls has the potential to enhance the effectiveness of US Armed Services performance.

3.1.2 Links Between Phases of Operations

Existing simulations do not link the phases of operation. Most training events focus on employment without addressing the constraints imposed by force deployment and sustainment issues. Although some useful tools to support deployment and sustainment have recently emerged, they have not been fully integrated into the simulation environment. Mobilization and redeployment issues are normally not addressed.

3.1.3 Strategic Effects

Existing simulations do not reflect the strategic effects of military operations. Deficiencies in current simulations require excessive intervention and tedious workarounds to inject effects of strategic attack.

3.2 *Composability Shortcomings*

3.2.1 Service Interoperability

Currently, no single M&S system nor combination of M&S systems provides a complete representation of the joint operational environment. Each Service has independent M&S systems that support their needs. While these legacy systems have served their purpose with respect to individual Service training needs, they do not adequately or efficiently operate with other Service systems to satisfy joint force commanders' training needs.

3.2.2 Database Construction

Certified, consolidated data repositories are not readily available and database construction remains a time-consuming, manpower-intensive process. For example, each individual model

component of the current JTC has its own unique database format that must be carefully coordinated prior to each training event. An update or change in a single model's database can adversely generate additional change requirements throughout the other confederation models. Standardized tools to automate the archiving, cross-checking, manipulation, retrieval, and transfer of data elements do not exist.

3.2.3 Environmental Effects and Environmental Impacts Standardization and Integration

There is no standard method to incorporate consistent, natural, or physical environmental effects such as the effects of the environment on military operations in a simulation integrating two or more models. Neither is there a standard method to incorporate impacts on the environment caused by military actions and interactions.

3.2.4 Enhancement Capability

It is difficult and expensive to make significant enhancements to existing models, and it is no longer cost-effective to update the models to support evolving joint and Service training requirements. Proprietary software, limited graphics capabilities, non-modular design, and hard-coded data representations do not integrate easily into an open systems environment.

3.2.5 Interaction and Connectivity

The existing simulation systems do not provide users the ability to interact freely with each other through the simulation, nor can they leverage other simulation capabilities through electronic connectivity.

3.2.6 C4I Interface

In general, existing systems do not allow the simulation to interface with existing C4I systems in a comprehensive fashion. Existing simulations require specialized equipment to display information. There are also limitations in the design of human interface equipment supporting the C4I systems. Therefore, users are often forced to participate in simulation-supported events using unfamiliar equipment and interfaces.

3.2.7 Links to Virtual and Live Entities

Current constructive simulations have a very limited capability to link virtual and live entities.

3.2.8 Links to Joint Training System

Existing simulations do not fully support the design, planning, preparation, execution, and post-exercise stages of the joint exercise life cycle, which supports the Joint Training System. Current simulations do not possess capabilities that provide linkages between critical scenario components (e.g., UJTL, JMETLs, training objectives, MSEL, data collection, AAR, etc.). The lack of systematic linkages has the potential to require unnecessary system processing and bandwidth resources.

3.3 *Efficiency Shortcomings*

3.3.1 Manning Levels

Existing US Armed Forces M&S systems require extensive personnel support for Service and joint exercises. Deficiencies in current simulations require personnel to intervene in simulations or script actions. Numerous role players must portray higher, adjacent, and lower echelons of friendly forces that are not participating in the exercise. Other personnel are required to execute opposing force activities. In addition, substantial personnel augmentation is required to operate computer systems and to enter manually plans, instructions, and orders to support the training scenario.

3.3.2 Trainer and Provider Tools

Existing M&S systems also lack a complete array of trainer and provider tools required to facilitate efficient planning and execution of training events. For example, no existing system has adequately integrated joint after action review (AAR) functionality, and tools to support rapid scenario generation do not exist. Those tools that do exist generally provide stand-alone capabilities (i.e., the output from one tool does not necessarily provide input for another tool). This often results in the requirement to re-enter data required during exercise development. A particular deficiency in current systems is related to tools to support the real-time control of or data collection during exercise execution.

3.3.3 Combat Adjudication

The combat adjudication process in current models developed by the joint and Service communities does not replicate a complete operational environment, requiring significant manpower to replicate the battle damage assessment (BDA) process.

3.3.4 Military Operations Other Than War (MOOTW) Scenario Support

Although MOOTW has dominated recent employment of US Armed Forces, existing M&S systems do not replicate MOOTW scenarios, particularly with respect to burgeoning joint training requirements. On a larger scale, social, economic, and political factors affecting missions across the full range of military operations are not adequately modeled to support joint training, requiring significant manpower to script this into an exercise.

4. Capabilities Required

JSIMS operational performance requirements were developed by the users in an extensive and cooperative process. One early product of the process was the ***JSIMS Functional Requirements Document (FRD)***, 20 November 1996. The extensive FRD effort examined uses of current and projected modeling and simulation (M&S) training tools. Characteristics of these uses were analyzed and aligned into the seven consolidated use cases identified in figure 4.1. These are the general purposes for which JSIMS may be used.

The executive agents defined performance parameters, four of which are designated as key performance parameters (KPPs). KPPs are the essential capabilities or characteristics JSIMS must exhibit. Attainment of a KPP is measured against a threshold (minimum) and objective (desired) standard. JSIMS performance parameters, including KPPs, are listed below. Following the performance parameters are tables that provide additional examples of system performance requirements listed by the attributes of tailorability, composability, and efficiency.

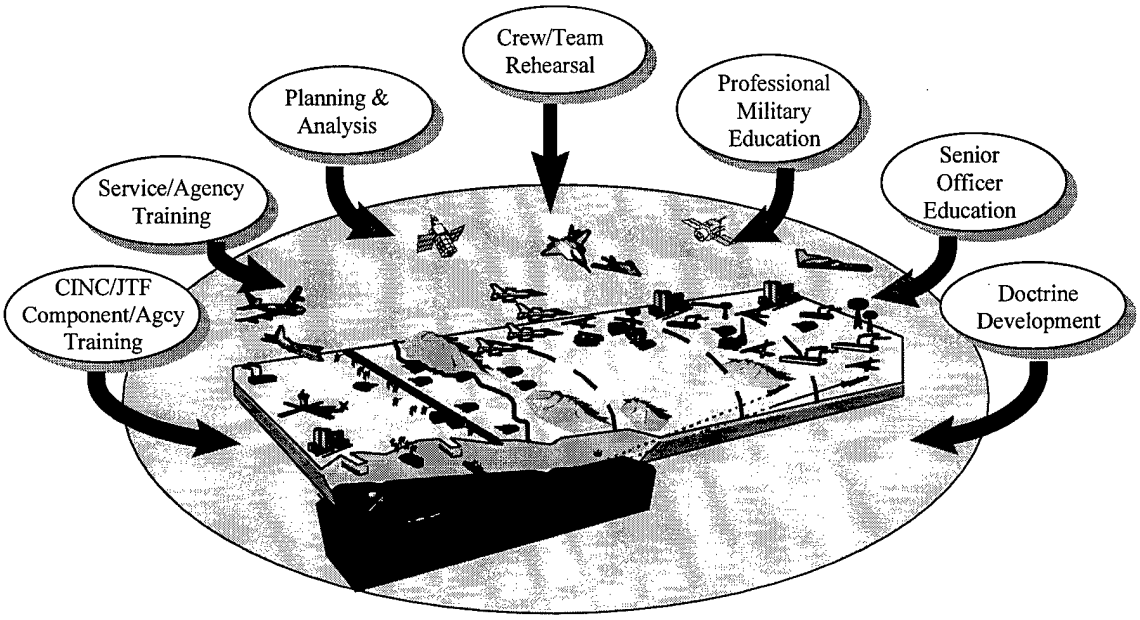

Figure 4.1 – JSIMS Consolidated Use Cases in the FRD

4.1 *System Performance*

4.1.1 Tailorability - Set of Operational Tasks and Conditions (KPP 1)

Threshold: Support training of CINC Joint Mission Essential Task Lists and Service Task List items, using the CINC/JTF Training with Components Functional Capability (FC J-3 Operations Minimum), which is consistent with the ***CJCSI 3500.02A Joint Training Master Plan***, 1998 CINC Joint Training Plans, and the JSIMS Universal Capabilities List (JUCL) (Refer to Functional Capabilities in Glossary).

Objective: To support the full range of UJTL tasks and conditions described in Chairman of the Joint Chiefs of Staff Manual 3500.04 series.

4.1.2 Composability - Trainer/User C4I System Interface (KPP 2)

Threshold: Interface with the following systems or programmed replacements: Common Operational Picture (COP) of the Global Command and Control System (GCCS), Joint Maritime Command Information System (JMCIS), Contingency Theater Automated Planning System/Theater Battle Management Core Systems (CTAPS/TBMCS), Logistics Anchor Desk (LAD), Army Tactical Command and Control System (ATCCS), Joint Worldwide Intelligence Communications System (JWICS), and Global Transportation Network (GTN).

Objective: Full integration with all joint, Service, and special operations C4I systems; includes voice recognition.

4.1.3 Composability - Distributed Simulation Environment (KPP 3)

Threshold: Given a DOD network infrastructure, JSIMS shall provide distribution of the JSB to geographically separated participants and shall support distribution to simulators that will be designed to be linked to JSIMS via Service-developed interfaces.

Objective: JSIMS should support Service distribution to deployed platforms and units to allow collaborative exercises at geographically remote sites.

4.1.4 (Other) - Simulation System Uptime Ratio (KPP 4)

Threshold: Simulation system availability of at least 90% during a 14 day, 24 hours per day computer assisted exercise (CAX).

Objective: Achieve 95% simulation system availability during a 14 day, 24 hours per day CAX.

4.1.5 Tailorability - Simulation Time Management

Threshold: Operate a CINC/CJTF scenario at variable speeds up to 4:1 (Faster than real-time). (Note: Game speeds greater than 1:1 will be used for analysis/mission rehearsal/limited HITL exercise support with limited real-world C4I connectivity.)

Objective: Operate a CINC/CJTF scenario at variable speeds: 1:10 (slower than real-time); 100:1 (faster than real-time with fully automated computer generated forces).

4.1.6 Composability - Extensible Training Environment

Threshold: The JSIMS environment is compliant with HLA specifications. The architecture supports composability to meet both present and future training environments. The object and data structure are extensible to support interaction with virtual and live applications and other constructive simulations.

Objective: The threshold defines the objective.

4.1.7 Composability/Efficiency - Database Construction

Threshold: Construction of a joint synthetic battlespace (JSB) for a CINC/CJTF exercise within a 30 day period, given complete and appropriate source data within approved, certified data repositories.

Objective: Construction of a JSB for CINC/CJTF operational support within 96 hours, given complete and appropriate source data within approved, certified data repositories.

4.1.8 Efficiency - Reduction in Exercise Support Personnel

Threshold: Reduce the present CINC/CJTF training support personnel overhead by at least 10% while providing the equivalent level of training functionality.

Objective: Reduce the present CINC/CJTF training support personnel overhead by two-thirds while providing the equivalent level of training functionality.

4.1.9 Detailed Performance Requirements

Additional functional requirements are presented below. Numbers in parentheses identify requirements derived from the JSIMS FRD, using its numbering protocol. If there is no FRD number presented, the requirement was established by later collaboration with JSIMS EAs and CINCs' representatives. Requirements for future uses of JSIMS, such as those required by JV 2010, are also included.

4.1.10 Tailorability Requirements

4.1.10.1	**Provide a JSB representing all warfare domains and applicable functions at a level of fidelity appropriate for the simulation event (1.1.2).**
4.1.10.1.1	JSIMS must support a range of scenarios defined in terms of: scope; size of the battlespace; and inclusion of unique warfare areas. 1. Major Theater Wars (MTWs). 2. Smaller Scale Contingencies (SSCs). 3. Military operations other than war (MOOTW) (2.2.2). 4. Global operations battlespace (2.2.1, 2.4.3). 5. Multiple non-contiguous theaters battlespace (2.4.3). 6. Single theater battlespace. 7. Nuclear-biological-chemical (NBC) warfare. 8. Theater missile defense (TMD) warfare. 9. Weapons of mass destruction (WMD) warfare. 10. Space warfare. 11. Information Operations. 12. Non-battlespace areas needed to show strategic infrastructure targets. (Note: MOOTW scenarios include interagency activities and interfaces with other elements of the US Government and outside agencies or governments such as: DEA, FBI, CIA, ATF, DOT, DOS, DOJ, FEMA, OFDA, US Secret Service, Red Cross, etc. MOOTW scenarios and NBC, TMD and WMD events can stand alone or comprise an integral part of an LRC, MTW or other scenario.)
4.1.10.1.2	Model all five phases of military operations (2.3.1): 1. Mobilization. 2. Deployment. 3. Employment. 4. Sustainment. 5. Redeployment. 6. The system must also move seamlessly from one phase of operation to the next (2.3.2). 7. Simultaneously represent different phases for multiple MTW scenarios (2.3.3).

4.1.10.1.3	For supporting the training requirements of both regional and functional CINCs, JSIMS must incorporate or support: 1. Simulations of land, maritime, air/space, and special operations forces across the full range of military operations from multiple major theater wars (MTWs) to military operations other than war (MOOTW). 2. The full range of military operations (including special operations), intelligence, environmental information support, logistics, communications, origin to destination transportation, and medical. 3. UJTL tasks associated with CINC JMETLS and common tasks contained in ***CJCSI 3500.02A***. Tasks must be performed under conditions associated with CINC JMETLs and the common task list contained in ***CJCSI 3500.02A***. Tasks must be performed to standards associated with CINC JMETLs and tasks contained in the ***JTF-HQ-MTG*** and subordinate MTGs. Capability to support Service specific training will be that associated with Service Task Lists. (2.1.1). 4. Links between training objectives (performance, training situation, level of performance) and tasks. 5. The capability to model the effects of planned or simulated military actions and operations on physical, military, and civil environmental conditions, particularly the effects of military actions on political, economic, and social conditions. (Note: While the regional CINCs may focus on the execution phase of military activities, functional CINCs often focus on deployment, sustainment, and specialized actions during the employment. Functional CINCs, therefore, will require more use of computer generated forces (CGF) and automation of functions.)
4.1.10.1.4	For operational assessment and crisis action planning, JSIMS must incorporate or support: 1. Warning indicators, improved assessment of capabilities and intentions. 2. Tools for analyzing vulnerabilities and means for developing course of action recommendations on existing or emerging threats. 3. Timely identification of data and information to support intelligence cycle functions of planning and directing, collection, processing, production, dissemination, and evaluation. 4. Functional capability to simulate effects of mission rehearsal actions or proposed operations in courses of action on the physical, military, political, economic, and social environments in the simulated region.

4.1.10.1.5	For operational planning and analysis, JSIMS must incorporate or support: 1. Greater fidelity and levels of resolution down to individual entity level, with a higher degree of behavior complexity (3.3.1). 2. Automation of large portions of the simulation (3.3.2). 3. Independent excursions without disrupting the main scenario (3.3.3) (Note: For this application, user audiences are much smaller than in training exercises requiring more use of CGF and automation of functions (3.3.8)).

1

4.1.10.2	**Incorporate the effects of military and non-military factors and special operations activities on mission critical tasks.**
4.1.10.2.1	Provide the capability to model and simulate interactively the primary and follow-on effects of the following factors on the outcomes of simulated military operations, as well as model and simulate interactively the primary and follow-on effects of military and non-military operations on these factors (1.1.7): 1. Political organizations. 2. Social factors. 3. Economic and physical infrastructures. 4. Psychological operations. 5. Civil affairs.
4.1.10.2.2	Provide the capability to simulate impacts on, the natural behavior of, or effects of: 1. Terrain. 2. Ocean environment. 3. Atmosphere. 4. Space environment.
4.1.10.2.3	Have the capability to model (2.5.2) (2.5.3): 1. At least 10 sides. 2. Any combination of up to 30 sides and factions. 3. Factions must be allowed to form and change sides during an exercise. 4. Military operations in urban terrain. (Note: Sides are composed of objects that share the same relationship to other sides, for example: enemy, suspect, neutral, or friendly. Factions are subsets of sides that include a wide range of organizations: military units; government agencies; international organizations; private volunteer organizations; paramilitary groups; and groupings.)

2

4.1.10.3	**Provide the capability to support unique simulation environments to meet the needs of the simulation audience and the exercise control group.**
4.1.10.3.1	Support a simulation environment that approaches actual operational conditions for the training audience. 1. The training audience should be able to employ their standard operating procedures. 2. The training audience should not be able to distinguish between real and simulated entities (1.1.1). 3. Where real C4I systems are not available, such as educational institutions, JSIMS must provide the capability to emulate designated Service and joint C4I systems with highly stylized and compressed formats (3.5.2). 4. Provide the capability to select between a 2D and 3D display of any point in the JSB from any perspective that is consistent with the position, status, and capabilities of assigned units (1.2.8.3), (1.2.7.3). 5. Displays must reflect the tactical environment at the point of observation and be subject to real-world constraints such as line of sight, time of day, battlefield obscurants, the degree to which opposing units are in defilade, etc. 6. Provide a multilingual capability. Target languages include Arabic, French, German, Hangul, Portuguese, and Spanish. (Note: This is not to imply that JSIMS will interface with foreign C4I systems.) 7. Provide for implementation and employment of non-U.S. C4I systems when developed by U.S. or foreign agencies to applicable DISA and JSIMS standards and requirements and per international agreements.

4.1.10.3.2	Allow selection of different functional applications and levels of detail, to include all potential opposing forces (OPFOR), allies, and neutrals, within an application (e.g., tactical, operational, and strategic levels of warfare for training and exercising). 1. Represent units down to company, aircraft, and team level (3.2.2). 2. The capability to task-organize while the simulation is running must be provided (3.1.4). 3. Provide the capability to track information at the lowest level, including the entity level in selected situations, with the volume, frequency, and quality of information metered by real-world capabilities. 4. Include the behavioral characteristics of OPFOR units to exploit fully the strategic and tactical advantages of information operations (IO), without a significant increase in OPFOR role players and controllers (3.1.3). 5. Scale opposing forces to a level commensurate with U.S. and friendly force levels, training objectives, intensity of anticipated combat, and length of exercise (1.2.2.4). 6. Provide a rule-based system of on-line queries, to highlight major areas of interest and critical events consistent with the role player's field of influence and assigned area of responsibility (1.2.8.4). 7. Provide multimedia capabilities for simultaneous, synchronized display of high-resolution, 3D, out-the-window and stealth views of the battlefield; communications traffic from selected nets; map views with terrain and cultural features; overlays and entity icons; graphic and tabular displays; text and graphic displays from operational orders, messages, doctrinal references, stored demonstrations, and lessons learned resource libraries.
4.1.10.3.3	Model information operations and represent its adverse effects on C4I systems performance within simulated environments (2.8.3): 1. Degradation of the battlefield, or decision making in a peacetime or pre-conflict situation, when critical technology-based "information systems" are attacked or damaged. 2. Impact of electronic, information, and general warfare on friendly and enemy computer networks, communications systems, integrated radar systems, environmental information systems, and intelligence support systems. 3. Impact of electronic, information, and general warfare on a friendly or a threat organization's ability to function and carry out missions.

4.1.10.3.4	Replicate real-world intelligence sensors and provide associated products: 1. Provide the capability to replicate sensors and platforms, such as JSTARS, that are not yet operational. 2. Model the ability to task tactical and national intelligence assets to include sensors, special operations personnel, and their associated platforms. 3. Provide training audiences with the information necessary to execute the battle damage assessment (BDA) process. 4. Provide comprehensive BDA assessments or reports suitable for use by the training audience when the training audience does not perform the BDA process. 5. Products must mirror current DOD standards as appropriate for the sensor. 6. The intelligence collection manager (CM) must be able to use existing, real-world CM tools to plan and direct collection by available assets, determine success and failure rates, and optimize allocation of intelligence assets.
4.1.10.3.5	Provide the exercise control group the capability to: 1. Compare game truth with the C4I displays being provided to the training audience (1.2.7.3). 2. Change, add, or delete, in whole or in part, the conditions that trigger automatic, game-generated responses and the form those responses take (e.g., report, flashing icon, on-line message, file entry, etc.). 3. Query the status of any object, real or simulated, using windows-type pull down menus (1.2.7.6). 4. Modify or override any game command, regardless of source (1.2.7.7). 5. Provide 2D and 3D visualization of the JSB from the perspective of both the training audience and the exercise control group (1.2.7; 2.7.1). 6. Provide capabilities to compare continuously training audience performance to standards on a real-time basis. Comparisons must include process and product standards of performance (objective and subjective).
4.1.10.3.6	For educational uses, JSIMS must provide the capability to manage up to 10 (threshold)/54 (objective) concurrent and distinct scenarios to support education (1.2.7.4), including the ability to: 1. Interact with objects, to modify object characteristics (e.g., behavioral attributes, location, combat or supply status, side and faction relationships, organization relationships, etc.). 2. Introduce new objectives during the course of a scenario, all on a selective basis in terms of which games are being modified, without disrupting the simulation.

4.1.10.3.7	Provide the capability for the exercise control group to select between automated or manual control of assigned units, definable down to unit level: 1. Permit manual control of one unit, while automating the control of others (1.2.8.1). 2. Permit either automated control or manual control to entire sides, factions, functions, etc. 3. Permit direction of support functions (movement, logistics, etc.) for units under manual control (1.2.8.2). 4. Customize unit representations on-site, including force composition; force behavior and doctrine; force lay-down; command and support relationships; and the allocation of forces among the training audience, role players, and semi-automated/automated decision makers for all sides and factions (1.2.2.3). 5. Customize unit representation of sensors to allow exercise control group to negate or create contact information as necessary to achieve training objectives (e.g., radar or sonar contacts).
4.1.10.3.8	Have the capability to vary the game speed (2.11.1): 1. Step back in time (2.11.2). 2. Jump forward (2.11.3). 3. Pause the simulation. 4. Return to previous time without altering the state of the simulation prior to the step back. (Note: Jump forward capability includes moving the simulation forward in time as many as 100 days while representing the effects of simulated activity—consumption, attrition, maneuver, weather, etc.—that would have occurred during the period of the jump.)
4.1.10.3.9	Provide the capability to support daily, intermittent, and final after action reviews (AARs): 1. Capability to determine how the AAR process and products will be distributed to training audience elements located in dispersed sites. 2. Identification of the products (summaries, post-exercise reports, take home packages) and determination of the process and elements of evaluation of the suitability of the training environment to meet training objectives. 3. Planning for the comparison of results of the current event with evaluations of similar or related events carried out previously or with established performance standards.

4.1.10.3.10	For mission rehearsal, JSIMS must provide a virtual environment that includes immersive 3D visualization of the battlespace. 1. View and interact in a simulated 3D environment in which the simulation recognizes and reacts to the users' presence. 2. Represent multi-spectral, correlated signatures of objects (e.g., an infrared source viewed through night vision goggles and radar depictions that correlate with visual displays) (3.4.2).
4.1.10.4	**Provide JSIMS users the capability to modify JSIMS objects so that new warfighting concepts or equipment can be simulated.**
4.1.10.4.1	Be capable of displaying the status of any simulated infrastructure or network (e.g., communications, power distribution grids, lines of communication, pipelines, etc.) (1.2.7.2).
4.1.10.4.2	Be capable of modeling new capabilities to improve protection against weapons of mass destruction: 1. Point and standoff detection. 2. Assessment and warning. 3. Prediction of effects (1.6.3.4). 4. Anti-satellite and satellite defense capabilities (1.6.3.5). 5. Improved capabilities for deception and use of decoys (1.6.3.6).
4.1.10.4.3	Be capable of modeling logistics (including the Defense Transportation System): 1. The effects of logistics and transportation on operational tempo, battlefield densities, service life of weapons systems, deadline rates and down-time, etc. (1.6.5.1). 2. The effects of precision operations on demands for logistical and transportation support (1.6.5.2). 3. The vulnerability of logistical and transportation infrastructure to traditional enemy actions. 4. The increased threat to logistical and transportation infrastructure from information warfare (1.6.5.3). 5. Non-traditional logistical and transportation structures, including decreasing reliance on shore-based facilities, multinational logistic and transportation cooperatives, civilian or contracted capabilities, joint logistics over the shore (JLOTS), etc. (1.6.5.4). 6. The effects of OPTEMPO on logistical and transportation resources and ability to provide support including joint total asset visibility.

4.1.10.4.4	Be capable of modeling target acquisition and fire support organizations that streamline decision-making and control, including the ability to: 1. Simulate nontraditional, cross-Service links between target acquisition systems and weapons systems (1.6.2.1). 2. Simulate direct shooter-sensor links such as sensor-fused weapons systems (1.6.2.2). 3. Simulate improvements in all-weather, real-time targeting and lethality at extended ranges. 4. Simulate the resultant effects on tempo, force-on-force ratios, battlefield densities, close combat, movement exposure, logistical requirements, etc., (1.6.2.3).
4.1.10.4.5	Be capable of modeling: 1. Attack of hardened, underground targets employing non-explosive warheads (1.6.2.4). 2. Effects of less-than-lethal munitions (1.6.2.5). 3. Projected space force application systems such as space based laser and military space plane munitions (1.6). 4. New capabilities to detect, acquire, track, destroy, and perform kill assessment of enemy strategic and theater ballistic and cruise missiles. 5. Dissemination of missile-strike warning across the theater (1.6.3.1). 6. New capabilities to differentiate potential targets as friend, foe, or neutral 1.6.3.2). 7. Improvements in enemy and friendly signature control, including increasing use of stealth technology with air, ground, and sea maneuver platforms, as well as on an individual basis (1.6.3.3). 8. Reconnaissance, surveillance, and target acquisition (RSTA) capabilities to be provided by remotely piloted vehicles and unmanned aerial vehicles. 9. Wide-area, linked, air-ground sensor systems; advanced radars; pattern-recognizing software (e.g., automatic target recognition algorithms); and improved space-based platforms (1.6.1.1).
4.1.10.4.6	Be capable of modeling vulnerabilities that accompany increasing reliance on information systems for military operations: 1. Adversary actions to destroy, disable, jam, saturate, misinform, deceive, or exploit U.S. information systems (e.g., computer viruses, hacker activities, focused electromagnetic pulse strikes, electronic deception, etc.). 2. Actions taken to defend against adversary attacks (1.6.1.2). 3. Be capable of simulating military operations under various levels of information superiority or information degradation (1.6.1.3). 4. Degradation of satellite constellations and ground stations disrupted by hostile operations.

4.1.11 Composability Requirements

4.1.11.1	**Provide the capability to operate in a distributed mode to dispersed training audiences, with or without external support, as well as the ability to conduct smaller events in a stand-alone mode using organic resources.**
4.1.11.1.1	Distribution of the system's multiple capabilities must be customized to each level, present the appropriate fidelity at each level, and be active or available from planning through post-event assessment: 1. Provide ability to link live, virtual, and other constructive simulations between users at various echelons to form an environment that stimulates a user's C4I systems (1.1.6). 2. Display simulation results on users' C4I systems or their emulation for training and exercises. 3. Display after action review material on organic C4I equipment. 4. Emulated displays should use operational symbols, notations, and terminology. 5. Provide the system with the safeguards to prevent confusion with real-world events and permit orderly transition from exercise to real-world operations (2.8.1). 6. Distribute required information to all JSIMS elements in such a manner that no single element's picture of the simulation is more than 30 seconds (threshold)/10 seconds (objective) behind that of the simulation, and all real-time C4I systems are updated in real-time and reflect current game state within the performance factors that represent real-world system performance.
4.1.11.1.2	Provide the ability to use JSIMS from real-world duty locations (1.1.5). 1. Maintain time and spatial consistency as the number of entities and accompanying interactions increase. 2. Accommodate multi-echelon exercises in which different scales of simulation, including live, virtual and other constructive simulations, are interacting (1.3.3). 3. For operational planning and analysis, interface with real-world planning systems and provide "what-if" capabilities; the system must be able to run independent excursions without disrupting the main scenario (3.3.3). 4. Have the ability to operate in a distributed mode (2.6.2), to various dispersed training audiences, with or without external support, coupled with the ability to conduct smaller events in a stand-alone mode using organic resources.

4.1.11.1.3	Provide for Humans-in-the-loop (HITLs) control, even if the procedure can be executed automatically. 1. HITLs capability must be available with all simulations executing concurrently, including those above and below the echelon of command of the simulation being played. 2. HITLs must be available with computer generated forces CGF representing friendly, neutral, and opposing forces. 3. HITLs must be able to combine with and to switch between HITLs and semi-automated forces during execution.
4.1.11.1.4	Support network switching and related communication management functions (1.2.6.3). 1. Support test of systems configuration (including communications protocols), equipment operation, network connectivity, and integrity of network security in a distributed environment (1.2.6.1). 2. Support test of the operational integrity of C4I systems with dual access to real-world and exercise data (1.2.4.3).
4.1.11.1.5	Provide exercise controllers the ability to start, freeze, stop, fast forward, restart, shutdown; to take a snapshot of all data in the system; to record selected events; to select the time scale in which to operate; to vary game speed; and to manage system configuration (i.e., distributed, single site). 1. Support technical management functions such as time control/game ratio; check points and archiving functions; systems/networking monitoring; crash recovery and record keeping. Systems saves should be accomplished in background mode without pausing the simulation. System monitoring includes interfaces with other simulations, simulators, live forces, and ranges. 2. Include the capability to save all components without affecting the speed/game ratio (e.g., if system was set at 1:1 before "save," it remains 1:1 during "save").
4.1.11.2	**Provide the capability to access and manipulate information from other knowledge and information resources.**
4.1.11.2.1	Access and download data from command and control systems: 1. Service and joint planning systems (e.g., time phased force deployment list (TPFDL) and air tasking order (ATO)). 2. Database repositories. 3. Other simulations. 4. Service and joint analysis systems. 5. Archived data from real-world operations (including operationally derived performance data), field training exercises (FTX), and other computer assisted exercises (1.2.3.2).

4.1.11.2.2	Support the synthesis of generic, real, real-displaced and other databases using data from multiple real-world sources (1.2.3.1). JSIMS must be capable of: 1. Building databases in all four categories (e.g., Generic - representation of a generic physical environment; real - representation of a real-world physical environment; real-displaced - representation of a real-world physical environment translated to another geographic location; other - representation of a physical environment influenced by other factors, i.e., smoke/obscurants, nuclear effects, virtual simulation, etc. (2.9.4). 2. Electronically passing data from a central facility to remote C4I nodes. 3. Populating replicated C4I databases with exercise data generated using scenario and database preparation tools (1.2.4.2). 4. Modification to environmental, object, and JSIMS replicated C4I database structures during the exercise without disrupting the simulation (1.2.6.2). 5. Representing four types of environmental data: historical, climatic extremes, observed, and forecast (2.9.1). 6. Formatting data into three categories: dynamic (2.9.2), interactive, or static (2.9.3). 7. Providing real-time interactions between the JSIMS scenario and replicated or actual real-world database structures (1.1.3). 8. Accessing intelligence networks and databases to update electronically location and status of real-world threat systems, units, etc., from operational systems/nets (Joint Deployable Intelligence Support System (JDISS), SIPRNET, Intelink, etc.) depicted within the JSIMS replication of the real-world database (1.2.2.5). 9. Accessing current environmental data in real-time, downloading it, and populating appropriate environmental databases (1.2.7.1) 10. Modifying data to support accomplishment of training objectives.
4.1.11.2.3	In the event of a software failure, JSIMS must include capability to resume the simulation such that simulation time and state are the same as at the point of failure. 1. JSIMS must resume operations no later than 1 hour (threshold)/within 15 minutes (objective) after fault detection. 2. JSIMS will be fault tolerant; no single JSIMS component will cause total system failure; and system operation will be able to continue, albeit in a degraded fashion, if a component fails.

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4.1.12 Efficiency Requirements

4.1.12.1	**Incorporate tools and automated routines to facilitate responsive design, planning, and preparation processes for JSIMS events, including the creation of verified and validated databases and scenarios for certification and accreditation.**
4.1.12.1.1	Incorporate tools and features to reduce the time required to train organic and system operators (2.12.3).
4.1.12.1.2	Interface JSIMS tools with supporting and supported command planning systems, including the ability to transfer electronically developed plans and databases from operational systems to JSIMS (1.2.2.1). 1. Include tools to access, download, and manipulate data in training support systems such as JEMP and other similar Service training support systems (1.2.1.1). By entering information correlating to one or more of the JEMP components, this planning tool should return relevant information on the remaining components (1.2.1.2). 2. Automate design of composable communications architectures from user-defined assets (communications equipment, C4I systems, M&S related equipment/computers, exercise architecture, encryption devices, access to SATCOM, etc.).
4.1.12.1.3	Provide scenario generation tools to create and modify scenarios using graphical user interfaces and scenario tools: 1. Provide scenario tools to accomplish staff-related functions employing products that may be developed at various times and locations (1.2.2). For example, the exercise planner may use previously developed exercise objectives to plan an exercise, even though he or she may not have been a participant in the process that produced the objectives. 2. Provide scenario tools that allow the exercise planner to compile and integrate these products into a coherent, meaningful, and executable scenario. 3. Provide tools to support the rapid development of environmental and object databases. 4. Support the development, testing, and installation of new databases within 96 hours (threshold)/48 hours (objective); major modification, testing, and installation of an existing database within 24 hours (threshold)/12 hours (objective); and testing and installation of an off-the-shelf database in 4 hours (threshold)/2 hours (objective).

4.1.12.1.4	Provide tools and embedded routines to facilitate database development and accreditation of scenarios to support training events. 1. Database preparation tools provide users both the means to rapidly access, collect, and populate JSIMS data structures with information from multiple sources and the ability to test the synthesized databases for internal consistency and operational soundness (1.2.3). 2. Automate the identification of conditions required to support event objectives by correlating training objectives, supporting and enabling tasks, and associated standards with the requisite civil, military, and physical conditions described in the UJTL (1.2.2.2). 3. Test modifications to approved databases to include verification that modifications have the desired result without incurring unexpected side effects in other areas; internal consistency between data structures is maintained; and operational soundness is preserved (1.2.3.4). 4. Provide tools and routines to support the capability to make, archive, and compare multiple runs. Repeatability is not required, but the ability to support comparative and statistical analysis is required (3.3.4). This process includes the ability to define measures of effectiveness (3.3.5), automate data collection (3.3.6), and provide basic post-process capabilities (i.e., standard statistical packages, use of relational databases, automated formatting, and transfer to graphics support packages, etc.) (3.3.7).
4.1.12.2	**Incorporate tools and automated routines to reduce the effort required to execute a JSIMS event and provide a relevant after action review (AAR).**
4.1.12.2.1	Provide operational assessment and crisis planning tools that incorporate warning indicators, improved assessment of capabilities and intentions, tools for analyzing vulnerabilities, and means for developing course of action recommendations (3.3.3).
4.1.12.2.2	Provide embedded tools to gather and display information on JSIMS performance before and during the training event. 1. Provide the resource manager performance data on use of computer resources during the event. 2. The impact of JSIMS use on the communications network. 3. Downtime attributed to software and hardware components. 4. Performance data related to interfaces with other live, constructive, and virtual simulations (2.13.6). 5. A pre-exercise tool that considers both processing and bandwidth requirements to determine total system requirements for a given training scenario.

4.1.12.2.3	Provide automated AAR functions or tools to minimize the personnel required to prepare the AAR (2.13.7). 1. Provide comprehensive AAR tools to plan and evaluate the suitability of the training environment (conditions) and assessing task performance (1.2.5). 2. Automate the production and nomination of candidate AAR aids by providing expert logic aids for correlating exercise objectives to the data collection plan. 3. Automate the correlation of objectives, supporting and enabling tasks, and associated measures/criteria of standards, with the requisite civil, military, and physical conditions described in the UJTL (2.1.3).. 4. Support pre-event train-up for AAR analysts and observers detailed as members of the AAR cell. 5. Allow AAR analysts to select critical AAR events occurring over the electronic data stream to be monitored. JSIMS must have the capability to alert AAR analysts when a critical event or the conditions requiring a critical action occur. 6. Provide standardized AAR products incorporating playback capability: C4I and/or video products; access to doctrinal resources; UJTL statistical products; physical environmental conditions analysis; and observer inputs. Compare recorded ground truth with player perspective of the training event. Standardized products must be appropriate, related to UJTL/STL-derived training objectives, and distributable to each echelon being trained. 7. Provide capability for on-line analysis to capture, store, retrieve, and manipulate relevant, archived AAR information, particularly with respect to comparing the current training event with AARs of related, previous events. 8. Automatically archive information to other systems and organizations engaged in collecting lessons learned, training management, and determination of future training requirements. 9. Allow AAR analysts to integrate observed data with simulation data. Process or merge AAR information collected from different simulation environments. Tailor data collection to each training objective in terms of tasks, conditions, and standards to facilitate proficiency observations. 10. Provide tools to permit observers to enter observation data and AAR analysts to receive near real-time observations. 11. Provide AAR analysts the capability to modify automated data collection at any time, including the ability to define new conditions and standards and to modify or delete existing conditions and standards (1.2.7.8). 12. Provide immediate feedback for interim and final AARs within 1 hour (threshold)/30 minutes (objective) and a comprehensive debrief within 6 hours (threshold)/3 hours (objective).

4.2 *Logistics and Readiness*

In general, JSIMS hardware will use commercial off-the-shelf (COTS) products to allow for rapid setup and configuration. High quality COTS hardware, software, manuals, and technical data should be incorporated wherever possible provided it does not degrade accomplishment of unique military requirements. Simulation system availability was addressed in previous requirements discussion (See paragraph 4.1.4).

4.2.1 Evolution and Adaptability

The functional requirements for using M&S to support training, education, operating concepts, tactics, doctrine, and other areas are likely to change rapidly over time. Simultaneously, advances in hardware and software are expected to expand simulation capabilities. If JSIMS is to keep pace, its architecture must include the flexibility to respond to future functional requirements and to incorporate progress in hardware and software technology. Where feasible and appropriate, successful technological demonstrations such as Advanced Distributed Simulation (ADS) and Synthetic Theater of War (STOW) and other projects will be leveraged.

4.3 *Other System Characteristics*

4.3.1 JSIMS Learning Environment.

For training, JSIMS will be developed to support the establishment of a learning environment. An effective learning environment requires the deliberate and systematic application of valid learning strategies, methods, and tools. One approach to establish effective learning environments is the Event-Based Approach to Training (EBAT). EBAT does not refer to an event as an entire exercise scenario but, rather, to specific situations (i.e., events) within an exercise scenario that have been designed to provide an opportunity for participants to demonstrate proficiencies and deficiencies related to essential tasks. EBAT provides a systematic means of linking training objectives to events, to performance measures, to data collection, to feedback. EBAT provides a framework to support multi-faceted data collection (i.e., individual, team, outcome, processes).

Learning environments based on EBAT have resulted in improved training effectiveness in terms of enhancing participant performance and reducing requirements for training resources. EBAT supports the development of learning environments by providing methods, strategies, and tools that comply with Joint Training System requirements. Specifically, EBAT: (1) supports all stages of the Joint Exercise Life Cycle (JELC) (i.e., design, planning, preparation, execution, and post-exercise evaluation); (2) can provide learning objectives from the Universal Joint Task List (UJTL) and the results of the Joint Mission Essential Task List (JMETL) development process, which identify tasks, conditions, and outcome standards required for accomplishment of JTF assigned or anticipated missions, and (3) extends the UJTL and JMETL development process by providing mechanisms to develop effective process and outcome measures for feedback purposes. The EBAT framework can also be used to develop JSIMS exercises for other use case applications (e.g., professional military education, senior officer education, doctrine development, mission rehearsal).

4.3.2 Normal Operating Environment

The normal operating environment for JSIMS will be in the field, aboard ships, in small simulation sites, and in existing simulation, training, and command and control centers. JSIMS

components are not required to be capable of operating in nuclear, chemical, or electronic warfare environments.

4.3.3 Security & Releasability Considerations

Security considerations encompass four areas: classification level, the need for multiple levels of security, releasability, and system security.

4.3.3.1 Classification Level

JSIMS is required to accommodate security classifications ranging from UNCLASSIFIED through TS/SCI (top secret/sensitive compartmented information). Lower fidelity, multinational, and Army applications of JSIMS will tend toward unclassified operations, with a similar trend toward TS/SCI on the high-fidelity side.

4.3.3.2 Multiple Levels of Security

JSIMS must support elements of the training audience working at different classification levels or with different levels of access to classified information. JSIMS must accommodate multiple levels of automated system security.

4.3.3.3 Releasability

JSIMS will often support events that include multinational and interagency participation. As a result, JSIMS must have the capability to regulate access selectively to the simulation environment as a whole or to certain products.

4.3.3.4 System Security

Program protection will be applied throughout the JSIMS life cycle to maintain technical superiority, system integrity, and availability. System security measures must be applied to integrate facilities, procedures, and equipment. Embedded C4I systems must be designed to counter the threat vulnerabilities identified in ***Threat Environment Description on C4I Systems***, 15 January 1994 (classified document).

JSIMS will require protection from unauthorized access and will require protection from information security (INFOSEC) threats as defined by the designated approval authority at each anticipated deployment site.

The system must meet all security and TEMPEST requirements for interoperability with theater and national C4I systems and must be able to interchange data with these systems in DOD standard formats.

JSIMS must protect classified data through concepts integrated into system hardware and software as part of the architecture for storing, retrieving, and passing data. External protective devices may be used, but the integration of security safeguards into the hardware and software is preferred.

5. Program Support

Companion ORDs to the JSIMS ORD include those of WARSIM, NASM, JSIMS Maritime, and the USMC Addendum.

5.1 *Maintenance Planning*

JSIMS must make use of modular design and component technology to support integration of new hardware and software modules and substitution of compatible hardware to embrace the pace of technology. Maintenance will be conducted using best commercial practices. Costs must be considered in determining repair capabilities but should not override mission requirements.

5.1.1 Hardware Organizational Maintenance

In general, the users' JSIMS hardware will be maintained to support reliability, availability, and maintainability for distributed exercises by contractor maintenance technicians at the organization level. The contractor's repair level analysis will identify items of equipment, modules, etc. for repair and determine their repair location. Maintenance support will be supplied by the user's organization.

5.1.2 Performance Logging and Post-Deployment Software Support (PDSS)

The JSIMS integration and development (I&D) contractor must provide a plan for software support during development and fielding of JSIMS. In general, JSIMS software will be maintained using contractor logistics support for the life of the system. Problem reports and desired enhancements will be managed by the CCB. The I&D contractor must also develop and implement a plan for post-deployment software support and maintenance. Software maintenance concepts will be compatible with existing Service and DOD instructions and will support the use of modern computer-aided software engineering (CASE) tools for organization of actions, tracking, and documentation. Strict version control will be required of all offered portions of software systems or modules. Accepted, integrated versions will be formally qualified through implementation of a standardized procedure for use as a component of JSIMS. For further discussion of PDSS, see the ***JSIMS Logistics Support Plan*** (JLSP).

5.1.3 Support Equipment

Support equipment for maintenance will be kept to a minimum. The system will be designed to be maintained by standard test equipment and will include fault isolation capabilities to diagnose system faults in the simulation or the communication system. The system will use commercial off-the-shelf and resident and/or loaded diagnostic software to isolate to the line replaceable unit (LRU) level. In order to reduce the overhead associated with technical support, JSIMS technicians must be able to employ troubleshooting and infrastructure management tools from a centralized location over a distributed LAN/WAN (local area and wide area network).

5.2 *Human Systems Integration*

Modern human computer integration (HCI) concepts, accommodating novice through expert operators, must be incorporated in the JSIMS architecture to reduce the need for training at the computer operating system level, especially for response cell players and technical controllers. Reduction in need for training through use of "point and click" and other interfaces, with on-line help screens, is a goal of the system. As part of training, the contractor will provide tutorials, on-line references, manuals, and "help screens," to include all system configuration operations and operator maintenance.

5.2.1 Manpower Support

JSIMS should be developed to allow fielding with significantly reduced manpower. By FOC, the JSIMS objective is to reduce the number of simulation support personnel by two-thirds of those required for a JTC-supported, JTF-level exercise in 1997 (See paragraph 4.1.8). Personnel reductions will be accomplished incrementally through automation of many of the manpower-intensive functions typical of existing simulations (e.g., reduction in the number of exercise controllers through the use of tools for pre-event scenario generation, database build and modification, and automated AARs; reduction in the number of technical controllers through the use of automated configuration of the simulation environment and operation of the components of JSIMS from a central control location; and reduction in the number of role players through the use of CGF). Although substantial savings in overhead are anticipated through the personnel reductions described above, the majority of savings achieved by JSIMS will result from sharp reductions in the time and effort required during the design, planning, and preparation stages of the joint exercise life cycle for a JSIMS-supported exercise/event.

5.2.2 Operator Training Concept

5.3.2.1 JSIMS must reduce training support requirements by reducing the number of personnel required to operate the system and control the simulation.

5.3.2.2 JSIMS must minimize training requirements for exercise control staff, workstation operators, role players, and other support personnel.

5.3.2.3 Operation should be user friendly to the extent that less than 24 (threshold)/12 (objective) hours of training are required to train new personnel to operate and control the system.

5.3.2.4 Training for technical controllers must cover the life cycle of a JSIMS-assisted exercise.

5.3.2.5 The training will include hardware and software operation, installation procedures, checklists for normal and abnormal operations, diagnostic trouble-shooting, start/restart procedures, as well as any special procedures anticipated for a given training/education event.

5.3.2.6 The training must include computer-based tutorials, hands-on rehearsal sessions, and on-line help programs.

5.3 *Computer Resources*

5.3.1 System Flexibility

5.4.1.1 JSIMS will be compatible with existing network and interface systems infrastructure to facilitate implementation.

5.4.1.2 However, the system will be sufficiently robust to capitalize on emerging hardware and software interface technologies.

5.4.1.3 JSIMS must have the ability to add and delete workstations and reconfigure workstation functionality as required by the particular process (i.e., training, planning, or test and evaluation support) without stopping the simulation.

5.4.1.4 As described in Section 4, JSIMS must provide the framework to facilitate interoperability with HLA compliant, live, virtual, and constructive simulations developed independently of JSIMS.

5.4.1.5 The JSIMS object model (derived from the JCMMS) will comply with DOD technical framework and provide sufficient detail and documentation to allow other HLA compliant models to implement simulation object models (SOMs) that readily support interoperability within a JSIMS federation object model (FOM).

5.3.2 Open System Architecture and Standards

The system must comply with applicable provisions contained in the Joint Technical Architecture (JTA) to include Defense Information Infrastructure/Common Operating Environment (DII/COE) compliance. JSIMS will be developed in an open system environment to allow the portability of applications between heterogeneous hardware suites and to facilitate interoperability with Service-level systems and other existing and/or future systems. To facilitate software portability to existing, planned, and future hardware suites, all software will be developed in compliance with open system software standards. The JSIMS architecture will support the development of a learning environment by providing systematic linkages between all phases of the JTS and all stages of the JELC. The JSIMS architecture will support scenario development via a set of life cycle applications. Existing documented, maintainable, portable, government off-the-shelf (GOTS), or commercial off-the-shelf (COTS) software packages will be used to the maximum extent possible to satisfy identified requirements before dedicating resources to developing major system enhancements or new application components.

JSIMS workstations must be consistent with an open system environment. JSIMS should be hardware platform independent and, where technically feasible, should allow the computers already existing at each command to be used. The JSIMS design must facilitate the migration to improved workstations as they become available.

5.3.3 Software

JSIMS will be designed for portability and reusability in a modern, standards-based, supportable programming language using modern programming techniques and CASE tools where appropriate. Existing DOD and COTS products and non-developmental items (NDIs), as appropriate, will be used to the maximum extent possible within the constraints of the life cycle maintenance to reduce manpower and other support resources and permit ready technological

upgrades. Quality, non-proprietary software documentation, and source code that facilitates software maintenance will be developed and delivered.

Developed software will be modular so that the software can be changed and improved without affecting the design of other modules. The system will be developed with growth in mind. Software will employ error management aids and permit users to obtain on-line guidance by requesting help screens. Following the output of an error message, users should be permitted to request additional information at levels of increasing detail. JSIMS will be designed so that all data (i.e., parameters of the models, rules for expert systems, addresses for network nodes) are not hard-coded into the software. JSIMS will provide the flexibility to change system parameters, rules, and network configuration without disruption to an exercise. JSIMS must include system and software documentation adequate to support PDSS, training, and operations. In addition to hard copy, JSIMS documentation must be provided in digital form for on-line access. Such documentation might include:

- Executive overview consisting of scope, overview, requirements, and general JSIMS capabilities.
- Users' guide consisting of information on how to develop and structure input data, run the simulation, use any pre- and post-processors, utilize the AAR, and review output.
- Analyst manual consisting of system setup guide, methodologies and algorithms, input and key internal working variables, including input data dictionary.
- Programmer manual consisting of local and global variables and selected processing code.
- Verification and validation (V&V) manual consisting of sources, results, and limitations and benchmarks.
- OPFOR operator guide providing a general overview of OPFOR capabilities to aid the operator in exercise management and scenario development.

5.3.4 Configuration Management

JSIMS configuration management will incorporate inputs from CINCs and Services and respond to their users' needs. Each organization will be responsible for providing inputs relating to unique requirements to the configuration control board (CCB) for approval and through the JSIMS JPO for execution.

5.4 *Other Logistics Considerations*

Each site to receive JSIMS will require a tailored fielding plan to accommodate the assimilation of JSIMS by site personnel and its supported user staff. Site facility infrastructure, currently configured for optimum use by legacy models, may require adaptation to satisfy JSIMS configuration requirements. Each JSIMS site must provide the hardware and install software and communications to support JSIMS. For the five initial joint support sites to receive JSIMS (JTASC, JWFC, WPC, KBSC, and NDU) the JSIMS JPO's I&D contractor will install the JSIMS software, test the system, help conduct exercises to validate the model on site and train local site personnel. Subsequently, the I&D contractor will provide follow-on support through a central technical support facility. JSIMS JPO has surveyed these five initial joint user sites to identify installation requirements and proposed a hardware swap-out between users to overcome

shortfalls during user accreditation/certification and fielding. More detailed logistics support requirements associated with JSIMS introduction are provided in the ***JSIMS Transition and Logistics Support Plans***.

5.5 *Command, Control, Communications, Computers, and Intelligence (C4I)*

As described in Section 4, JSIMS must interface with existing and future C4I systems and use the Defense Information System Network (DISN) for transport when applicable and feasible. This interface includes data, voice, video, etc. for mission planning and execution, intelligence, and communications activities. The C4I systems described in paragraph 4.1.2 are real-world, operational C4I systems. The Services and joint community will coordinate through DISA to develop a comprehensive C4I integration plan.

5.6 *Transportation and Basing*

Existing simulation centers, training sites, educational facilities, and command centers are planned as primary host sites for JSIMS. These sites are located in several foreign countries, as well as in CONUS. The JSIMS site and infrastructure fielding plan will be developed separately. JSIMS equipment shall be able to be moved through air, land, and sea military and commercial transportation.

5.7 *Standardization, Interoperability, and Commonality*

Current CINC training requirements often involve exercises with allies and coalition partners, and JSIMS will be used to support those ongoing CINC requirements. JSIMS' planned HLA compliance, standardized data sources, and common core services should allow greater interoperability with external M&S efforts. Although JSIMS provides a framework to enhance interoperability with allied and coalition partners, it cannot be expected to provide universal capability to individual non-US exercise participants. Individual exercise requirements and the available M&S infrastructure of the participants will present unique security issues that must be handled on a case-by-case basis.

Release or transfer of any defense related technology, including M&S products, depends on the nature of items to be released in terms of classification, military value, and other factors, such as ownership and content of intellectual property. Two requirements must be met prior to release or transfer: (1) authority to release must be based on public law and policy; and (2) there must be an approved mechanism for transfer or release. Public law and policy includes: ***International Traffic in Arms Regulation (ITAR), Export Administration Regulation (EAR), National Disclosure Program*** (as implemented in ***DOD Directive 5230.11***), and ***DOD 5105.38-M***, which governs foreign military sales release procedures.

5.8 *Geospatial Information and Services*

JSIMS will use standardized terrain databases to facilitate interoperability with other systems and reduce costs. National Imagery and Mapping Agency (NIMA) will provide terrain database standards. At IOC JSIMS terrain data will meet digital terrain elevation data (DTED) level 1, digital feature analysis data (DFAD) level 1 resolution, interim terrain data (ITD)/vector product format ITD (VITD). The goal by FOC is for JSIMS to meet DTED Level 5, vector product

format (VPF) products (Vmap0-2, UVMap, ITD). JSIMS must have the ability to tailor terrain, atmospheric conditions, oceanographic conditions, and imagery in terms of fidelity and quality to create the training environment necessary to facilitate achievement of specific event training objectives.

5.9 *Environmental Support*

The standard JSIMS ocean, atmosphere and space environment support required are described in previous paragraphs. Unique support requirements will be drawn from CINCs' integrated priorities lists.

6. Force Structure

The total number of operational systems, subsystems, spares, and training units produced will be based on the training needs of the unified commanders, other joint organizations, and Services. The JSIMS program will procure hardware only to support JSIMS JPO and I&D activities. However, the program will identify a preferred hardware suite available for procurement.

7. Schedule Considerations

7.1 *Phasing of JSIMS Capabilities*

Refer to the JSIMS CONOPS and JSIMS Transition Plan for detailed descriptions of the intended sequence and constraints on the fielding of JSIMS. The current JTC to JSIMS Transition Plan calls for the JSIMS IOC capability in CY 1999.

7.2 *Models to be Replaced by JSIMS*

At IOC, JSIMS will focus on support for training at the strategic-theater and operational levels of war for unified combatant command staffs, joint task force (JTF) commander and staff, and JTF component commanders and staffs. It will further be used to support Service training requirements for component commands within the context of a joint force at the operational level. It will also be used to provide situational awareness and operational engagement adjudication for application in the context of joint force academic seminar training events.

In addition to incorporating the training functionality and benefit of the Joint Training Confederation, by FOC JSIMS will replace joint simulations that follow:

- Joint Theater Level Simulation (JTLS). JTLS is a multi-sided, interactive, computer-driven simulation that was designed as a theater-level model for use by commanders and planners in the analysis, development, and evaluation of operations plans.

- Joint Conflict and Tactical Simulation (JCATS). JCATS is a multi-sided, interactive, entity level joint conflict simulation that was developed to incorporate the functionality of the Joint Conflict Model (JCM) and the Joint Tactical Simulation (JTS).

8. Annex A -- ALSP Joint Training Confederation

The Joint Training Confederation (JTC) consists of constructive training simulations linked through ALSP infrastructure software (AIS) to provide an integrated training support environment for major CINC, Service, and multi-Service exercises. The best sources of information regarding the detailed capabilities and functionality of the JTC are the ALSP 1997 JTC Operational Specification (Final Draft version dated March 97 is available on the ALSP server) and the ALSP JTC Master Plan, Revision 1. These documents identify specific functionality in each of the simulations, individually and collectively. JSIMS is required to provide sufficient training functionality to train JTF commanders and staffs and component commanders and staffs at IOC. JSIMS is not required to provide the functionality available in most peripheral software systems (PSS) that interact with the 10 core JTC systems described below. This version (1.0) of JSIMS will provide the primary training functionality and benefit of the core JTC systems, with the exception of CSSTSS functionality. JSIMS should also have the functionality of the joint surveillance, target attack radar system (JSTARS) and unmanned aerial vehicle (UAV) simulations.

8.1 *Air Warfare Simulation 2.0 (AWSIM 2.0)*

AWSIM 2.0 portrays air combat and operations. It models all aspects of warfare that have an impact on Air Force activities, the forces that the Air Force employs (air and ground), and the targets and threats that it opposes. Administrative and logistics functions are also modeled.

8.2 *Research, Evaluation, and System Analysis (RESA) Simulation.*

RESA portrays naval operations. It models all Navy objects (surface, subsurface, and air) and all of their threats and targets. All naval warfare areas are simulated.

8.3 *Corps Battle Simulation (CBS)*

CBS represents land warfare and operations and is designed to train Army commanders and staffs at the division level and higher. It models Army combat, combat support, and combat service support operations and those aspects of air activity relevant to Army activity. CBS's internal combat service support (CSS) and air activities are disabled when operating in the JTC confederation.

8.4 *Marine Air/Ground Task Force (MAGTF) Tactical Warfare Simulation (MTWS)*

MTWS represents Marine Corps combat, including amphibious operations, ground warfare, and Marine air warfare (rotary and fixed wing).

8.5 *Joint Command and Control Warfare Center's (JC2WC) Joint Command & Control Warfare Simulation System (JCCWSS)*

The JC2WC's JCCWSS is a family of simulations that adjudicates attacks against strategic targets and provides battle damage assessments (BDA) and mission reports (MISREPS). It also listens to information about the electromagnetic environment and provides a consistent picture of the EW environment across the confederation. In addition, it provides a limited capability to portray the effects of information operations (IO). Members of this family include Joint C2 Attack Simulation (JCAS), Joint Electronic Command Electronic_Warfare Simulation (JECEWSI), Joint Networks Simulation (JNETS), and Joint Operations Information Simulation (JOISIM).

8.6 *Tactical Simulation (TACSIM)*

TACSIM replicates all intelligence collection assets available to an Army corps in theater. It listens for ground and sea orders of battle and air reconnaissance information and provides intelligence information and processed intelligence reports to the training audience in the appropriate formats.

8.7 *Combat Service Support Training Simulation System (CSSTSS)*

CSSTSS provides high resolution logistics play for CBS, including the training of Army logistics staff at all echelons. It includes transportation, sustainment, maintenance, and medical functions.

8.8 *Portable Space Model (PSM)*

PSM 'listens' to confederation traffic for all ballistic missile flights and injects this information (early warning) via exercise tagged messages into real-world tactical data dissemination systems. PSM models all three legs of the Theater Event System, satellite objects, and ground control stations. Improvements to PSM are in progress that will enable PSM to take weather effects into account in modeling the detection capability of the space based portion of the early warning system.

8.9 *Analysis of Mobility Platform (AMP)*

AMP is a collection of simulations that provides a detailed representation of transportation and personnel from home stations through destinations in theater. In the JTC, AMP represents strategic planning, in-theater transportation, and redeployment planning. Included in AMP are JFAST, FORCEFLO, MIDAS, MASS, and ELIST.

8.10 *Logistics Anchor Desk (LAD)*

LAD is a command and control system and planning tool that provides asset visibility for (Army) logistics planners and operations.

9. Annex B -- References

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10. Annex C -- List of Acronyms

AAR	After Action Review
ACC	Air Combat Command
ADS	Advanced Distributed Simulation
AFSAF	Air Force Semi-Automated Forces
AIM	AWSIM Interoperability with MODSAF
AIS	ALSP Infrastructure Software
ALSP	Aggregate Level Simulation Protocol
AMP	Analysis of Mobility Platform
AOR	Area of Responsibility
APB	Acquisition Program Baseline
ATO	Air Tasking Order
AV	Aviation
AWACS	Airborne Warning and Control System
AWSIM 2.0	Air Warfare Simulation 2.0
BDA	Battle Damage Assessment
C4I	Command, Control, Communications, Computers, and Intelligence
CAP	Crisis Action Planning
CASE	Computer Aided Software Engineering
CAX	Computer-Assisted Exercise
CBS	Corps Battle Simulation
CCB	Configuration Control Board
CGF	Computer Generated Forces
CINC	Commander in Chief
CJCS	Chairman, Joint Chiefs of Staff
CJCSI	Chairman, Joint Chiefs of Staff Instruction
COE	Common Operating Environment
CONOPS	Concept of Operations

COTS	Commercial Off-the-Shelf
CSSTSS	Combat Service Support Training Simulation System
CTAPS	Contingency Theater Automated Planning System
DA	Development Agent
DARPA	Defense Advanced Research Project Agency
DFAD	Digital Feature Analysis Data
DIA	Defense Intelligence Agency
DII	Defense Information Infrastructure
DIS	Distributed Interactive Simulation
DISA	Defense Information Systems Agency
DMSO	Defense Modeling and Simulation Office
DOD	Department of Defense
DODIIS	Department of Defense Intelligence Information System
DOJ	Department of Justice
DOS	Department of State
DOT	Department of the Treasury
DTED	Digital Terrain Elevation Data
EA	Executive Agent
EADSIM	Extended Air Defense Simulation
EAR	Export Administration Regulation
EBAT	Event-Based Approach to Training
ECM	Electronic Countermeasures
ELIST	Enhanced Logistics Intra-Theater Support Tool
EMP	Electromagnetic Pulse
ENWGS	Enhanced Naval Warfare Gaming System
EUCOM	US European Command
EXSCHED	Exercise Schedule
FAAR	Facilitated AAR
FDP	Full Dimension Protection
FOC	Full Operational Capability

FOM	Federation Object Model
FORCEFLO	Force Flow ("Fort to Port" model in AMP)
FRD	Functional Requirements Document
FSCL	Fire Support Coordination Line
FTX	Field Training Exercise
GCC	Ground Component Command
GOTS	Government Off-the-Shelf
GTN	Global Transportation Network
GUI	Graphical Users Interface
HCI	Human Computer Interface
HITL	Human-in-the-Loop
HLA	High Level Architecture
INFOSEC	Information Security
IO	Information Operations
IOC	Initial Operational Capability
ISR	Intelligence, Surveillance, and Reconnaissance
ITAR	International Traffic in Arms Regulation
ITD	Interim Terrain Data
JAARS	Joint After Action Reporting System
JC2WC	Joint Command and Control Warfare Center
JCAS	Joint C2 Attack Simulation
JCATS	Joint Conflict and Tactical Simulation
JCCWSS	Joint Command and Control Warfare Simulation System
JECEWSI	Joint Electronic Combat Electronic Warfare Simulation
JCM	Joint Conflict Model
JCMMS	Joint Conceptual Model of the Mission Space
JDISS	Joint Deployable Intelligence Support System
JEMP	Joint Exercise Management Package
JESS	Joint Exercise Support System
JFAST	Joint Flow and Analysis System for Transportation

JFC	Joint Forces Command
JLOTS	Joint Logistics Over The Shore
JMET	Joint Mission Essential Task
JMETL	Joint Mission Essential Task List
JNETS	Joint Networks Simulation
JOA	Joint Operating Area
JOISIM	Joint Operations Information Simulation
JPO	Joint Program Office
JROC	Joint Requirements Oversight Council
JSB	Joint Synthetic Battlespace
JSIMS	Joint Simulation System
JSPS	Joint Strategic Planning System
JSR	Joint Strategy Review
JTC	Joint Training Confederation
JTF	Joint Task Force
JTLS	Joint Theater Level Simulation
JTS	Joint Tactical Simulation
JTS	Joint Training System
JULLS	Joint Universal Lessons Learned System
JV	Joint Venture
JWARS	Joint Warfare System
JWCA	Joint Warfighting Capability Assessment
KPP	Key Performance Parameter
LAD	Logistics Anchor Desk
LRC	Lesser Regional Contingency
LRU	Line Replaceable Unit
M&S	Modeling and Simulation
MAGTF	Marine Air/Ground Task Force
MASS	Mobility Analysis Support System
MEF	Marine Expeditionary Force

MFC	Marine Force Command
MIDAS	Model for Inter-Theater Deployment by Air and Sea
MISREP	Mission Report
MRM	Mission Requirements Module
MLS	Multi-level Security
MOOTW	Military Operations Other Than War
MOUT	Military Operations on Urban Terrain
MRC	Major Regional Contingency
MRCI	Modular Reconfigurable C4I Interface
MSEL	Master Scenario Events List
MSRR	Modeling and Simulation Resource Repository
MTW	Major Theater War
MTWS	MAGTF Tactical Warfare Simulation
NCA	National Command Authority
NCC	Naval Component Command
NDI	Non-developmental Item
NGO	Non-governmental Organizations
NIMA	National Imagery and Mapping Agency
NIPRNET	Unclassified but Sensitive Internet Protocol Router Network
OP	Operational
OPFOR	Opposing Forces
ORD	Operational Requirements Document
PACOM	US Pacific Command
PDSS	Post Deployment Software Support
POL	Petroleum, Oil, and Lubricants
PPBS	Planning, Programming ,and Budgeting System
PSM	Portable Space Model
PVO	Private Voluntary Organization
R&D	Research and Development
RESA	Research, Evaluation, and System Analysis Simulation

RPV	Remotely Piloted Vehicle
RSTA	Reconnaissance, Surveillance, and Target Acquisition
SAFOR	Semi-automated Forces
SAM	Surface-to-Air Missile
SATCOM	Satellite Communications
SCI	Sensitive Compartmented Information
SE	Synthetic Environment
SEAD	Suppression of Enemy Air Defenses
SIPRNET	Secret Internet Protocol Router Network
SOCOM	US Special Operations Command
SOM	Simulation Object Model
SOTF	Special Operations Task Force
SOUTHCOM	US Southern Command
SPACECOM	US Space Command
SSF	Software Support Facility
ST	Strategic-Theater
STOW	Synthetic Theater of War
TA	Tactical Level (UJTL Tasks)
TACSIM	Tactical Simulation
TACWAR	Tactical Warfare Simulation
TAFIM	Technical Architecture Framework for Information Management
TBMCS	Theater Battle Management Core Systems
TF	Task Force
TLAM	Tomahawk Land Attack Missile
TMD	Theater Missile Defense
TOC	Tactical Operations Center
TPFDL	Time Phased Force Deployment List
TS	Top Secret
STL	Service Task List
UAV	Unmanned Air Vehicle

UCC	Unified Combat Command
UJT	Universal Joint Task
UJTL	Universal Joint Task List
US	United States
USTRANSCOM	US Transportation Command
VITD	Vector Product Format Interim Terrain Data
VPF	Vector Product Format
VV&A	Verification, Validation, and Accreditation
WARSIM	Warfighter Simulation
WMD	Weapons of Mass Destruction
WOC	Wing Operations Center

11. Annex D -- Glossary

The following definitions were extracted from ***DOD Directive 5000.59-P, DOD Modeling and Simulation Master Plan*** and ***DOD Glossary of M &S Terms***. The sources for the definitions in this glossary have not been included. The sources are available in the reference documents.

Accreditation. The official certification that a model or simulation is acceptable for use for a specific purpose.

Advanced Distributed Simulation (ADS). A set of disparate models or simulations operating in a common synthetic environment in accordance with the Distributed Interactive Simulation (DIS) standards. The ADS may be composed of three modes of simulation: live, virtual, and constructive, which can be seamlessly integrated within a single exercise. See also: live simulation; virtual simulation; constructive simulation.

Aggregate Level Simulation Protocol (ALSP). A family of simulation interface protocols and supporting infrastructure software that permit the integration of distinct simulations and war-games. Combined, the interface protocols and software enable large-scale, distributed simulations and wargames of different domains to interact at the combat object and event level. The most widely known example of an ALSP confederation is the JTC, which has provided the backbone to many large, distributed, simulation-supported exercises. The 1997 JTC includes CBS, AWSIM 2.0, RESA, TACSIM, CSSTSS, PSM, JCCWSS, MTWS, AMP, and LAD.

Aggregation. The ability to group entities while preserving the effects of entity behavior and interaction while grouped. (See also, definition of disaggregation.)

Architecture. An architecture is the structure of components in a program or system, their interrelationships, and principles and guidelines governing their design and evolution over time.

Authoritative Representation. Authoritative representations are models, algorithms, and data that have been developed or approved by a source that has accurate technical knowledge of the entity or phenomenon to be modeled and its effects.

Battlespace. Battlespace refers both to the physical environment in which the simulated warfare will take place and the forces that will conduct the simulated warfare. All elements that support combat forces (e.g., logistics, intelligence) are included in this definition of battlespace.

Combatant Command(s). One of the unified or specified combatant commands established by the President of the United States. Combatant commands currently include: US Atlantic Command (USACOM); US Central Command (USCENTCOM); US European Command (USEUCOM); US Pacific Command (USPACOM); US Southern Command (USSOUTHCOM); US Space Command (USSPACECOM); US Special Operations Command (USSOCOM); US Strategic Command (USSTRATCOM); and, US Transportation Command (USTRANSCOM).

Computer Generated Forces (CGF). A generic term used to refer to computer representations of forces in simulations that attempt to model human behavior sufficiently so that the forces will take some actions automatically (without requiring humans-in-the-loop interaction). Also referred to as semi-automated forces (SAFOR).

Computer Simulation. A dynamic representation of a model, often involving some combination of executing code, control/display interface hardware, and interfaces to real-world equipment.

Data. A representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation, or processing by humans or by automatic means.

Data Certification. The determination that data have been verified and validated. Data user certification is the determination by the application sponsor or designated agent that data have been verified and validated as appropriate for the specific M&S usage. Data producer certification is the determination by the data producer that data have been verified and validated against documented standards or criteria.

Data Exchange Standard. Formally defined protocols for the format and content of data messages used for interchanging data between networked simulation and/or simulator nodes used to create and operate a distributed, time and space coherent synthetic environment. Current standards are ALSP and DIS PDUs.

Data Standardization. The process of documenting, reviewing, and approving unique names, definitions, characteristics, and representations of data according to established procedures and conventions.

Data Validation. The documented assessment of data by subject area experts and its comparison to known values. Data user validation is an assessment as appropriate for use in an intended model. Data producer validation is an assessment within stated criteria and assumptions.

Data Verification. Data producer verification is the use of techniques and procedures to ensure that data meets constraints defined by data standards and business rules derived from process and data modeling. Data user verification is the use of techniques and procedures to ensure that data meets user specified constraints defined by data standards and business rules derived from process and data modeling, and that data are transformed and formatted properly.

Data Verification, Validation, & Certification (VV&C). The process of verifying the internal consistency and correctness of data, validating that it represents real-world entities appropriate for its intended purpose or an expected range of purposes, and certifying it as having a specified level of quality or as being appropriate for a specified use, type of use, or range of uses. The process has two perspectives: producer and user process.

Disaggregation. The ability to represent the behavior of an aggregated unit in terms of its component entities. If the aggregate representation does not maintain state representations of the individual entities, the decomposition into the entities can only be notional.

Event-Based Approach to Training (EBAT). EBAT provides a systematic means of linking training objectives to events, to performance measures, to data collection, to feedback. EBAT does not refer to an event as an entire exercise but, rather, to an event as a specific situation (i.e., events) within an exercise that has been designed to provide an opportunity for participants to demonstrate proficiencies and deficiencies related to an essential task. EBAT: (1) supports all phases of the Joint Exercise Life Cycle (JELC) (i.e., design, planning, preparation, execution, and post-exercise evaluation); (2) provides learning objectives from the Universal Joint Task List (UJTL) and the results of the Joint Mission Essential Task List (JMETL) development process; and (3) extends the UJTL and JMETL development process by providing mechanisms to develop effective process and outcome measures for feedback purposes.

Environment. (1) The texture or detail of the domain (that is, terrain relief, weather, day, night, terrain cultural features (such as cities or farmland), sea states, etc.). (2) The external objects,

conditions, and processes that influence the behavior of a system (such as terrain relief, weather, day/night, terrain cultural features, etc.).

Environmental Representation. An authoritative representation of all or a part of the natural or man-made environment.

Extensibility. The ability of a data structure to accommodate additional values or iterations of data over time without impacting its initial design.

Fast Time. (l) Simulated time with the property that a given period of actual time represents more than that period of time in the system being modeled; for example, in a simulation of plant growth, running the simulation for one second may result in the model advancing time by one full day; that is, simulated time advances faster than actual time. (2) The duration of activities within a simulation in which simulated time advances faster than actual time. Contrast with: real-time; slow time.

Federation. A system of interacting models and/or simulations, with supporting infrastructure, based on a common understanding of the objects portrayed in the system.

Fidelity. (1) The similarity, both physical and functional, between the simulation and that which it simulates. (2) A measure of the realism of a simulation. (3) The degree to which the representation within a simulation is similar to a real-world object, feature, or condition in a measurable or perceivable manner.

Functional Capabilities (FC). Refers to capabilities defined by JSIMS functional use cases as follow:

Joint Use Capabilities

J1 CINC/JTF Training
J2 Supporting CINC Training
J3 CINC/JTF & Components Training
J4 JFLCC (Land Component) Training
J5 JFACC (Air Component) Training
J6 JFMCC (Maritime Component) Training
J7 JIC (Intelligence Center) Training
J8 JIC & JISE (Intel Support Element) Training
J9 JSOCC (Special Operations) Training

Air Force Use Capabilities

F1 AFFOR Training
F2 JFACC and JAOC Training
F3 Wing Commander and Senior Staff Training

Marine Corps Use Capabilities

M1 MEF Training
M2 MARFOR Training/Planning
M3 MEU (SOC) Training
M4 Amphibious Operations Training

Army Use Capabilities

A1 Corps Commander & Staff Training
A2 Corps/Division Commander & Staff
A3 Division Commander & Staff Training
A4 Battalion or Brigade Training
A5 Army Logistics Staff Training
A6 Army Intelligence Staff Training

Navy Use Capabilities

N1 Numbered Fleet Commander Training
N2 Carrier Battle Group Commander Trng
N3 Navy Task Group Commander
N4 Navy Warfare Commander Training
N5 Navy Ship Training

Other Use Capabilities

O1 Planning and Analysis
O2 Crew/Team Mission Rehearsal
O3 Senior Officer Education
O4 Professional Military Education
O5 Doctrine Development

Granularity. Fidelity and level of detail of objects and environment. See also: resolution.

Ground Truth. The actual facts of a situation, without errors introduced by sensors or human perception and judgment.

High Level Architecture (HLA). Major functional elements, interfaces, and design rules, pertaining as feasible to all DOD simulation applications and providing a common framework within which specific system architectures can be defined.

Host or Host Computer. A computer that supports one or more simulation applications. All host computers participating in a simulation exercise are connected by network(s) including wide area networks, local area networks, and RF links.

Human Factors. A body of scientific facts about human characteristics. The term covers all biomedical and psychological considerations; it includes, but is not limited to, principles and applications in the areas of human engineering, personnel selection, training, life support, job performance aids, and human performance evaluation.

Hybrid Simulation. A simulation that combines constructive, live, and/or virtual simulations, typically in a distributed environment. Such simulations combine simulators with actual operational equipment, prototypes of future systems, and realistic representations of operational environments.

Interaction. The explicit action taken by one object toward another object or geographical area.

Joint M&S. Representations of joint and Service forces, capabilities, equipment, materiel, and services used in the joint environment or by two or more military Services.

Learning Environment. The deliberate and systematic application of valid learning strategies, methods, and tools to enhance training system effectiveness and efficiency.

Legacy Model. A model developed in the past that is still in use and was not implemented using today's standards (e.g., software, communication, DIS, ALSP, etc.). Some legacy models have been modified with interfaces to some of the current standards, extending their usefulness and interoperability with newer, standards-based models.

Live, Virtual, and Constructive Simulation. The categorization of simulation into live, virtual, and constructive is problematic, because there is no clear division between these categories. Live Simulation: A simulation involving real people operating real systems. The degree of human participation in this simulation is infinitely variable, as is the degree of equipment realism. This categorization also suffers by excluding a category for simulated people working real equipment (e.g., smart vehicles). Virtual Simulation: A simulation involving real people operating simulated systems. Virtual simulations inject humans-in-the-loop (HITLs) in a central role by exercising motor control skills (e.g., flying an airplane), decision skills (e.g., committing fire control resources to action), or communication skills (e.g., as members of a C4I team). Constructive or Model Simulation: Models and simulations that involve simulated people operating simulated systems.

Mission Space. Mission space refers to the entities, actions, and interactions that must be represented to produce credible simulations of the specific mission area being addressed. Mission space includes all elements (e.g., logistics, intelligence, manufacturing) that support the simulation and that are required to achieve the desired goals and objectives.

Model. A physical, mathematical, or otherwise logical representation of a system, entity, phenomenon, or process.

Modeling and Simulation (M&S). The use of models, including emulators, prototypes, simulators, and stimulators, either statically or over time, to develop data as a basis for making managerial or technical decisions. The terms "modeling" and "simulation" are often used interchangeably.

Modeling and Simulation (M&S) Accreditation. The official certification that a model or simulation is acceptable for use for a specific purpose.

M&S Infrastructure. An underlying base or foundation; the basic facilities, equipment, and installations needed for the functioning of a system. A M&S infrastructure would consist of M&S systems and applications, communications networks, architectures, standards and protocols, information resource repositories, etc.

M&S Interoperability. The ability of a model or simulation to provide services to and accept services from other models and simulations and to use the services so exchanged to enable them to operate effectively together.

ModSAF. Modular Semi-Automated Forces are a class of CGF utilizing a modular software structure in which model components have well-defined and documented interfaces, allowing run-time reconfiguration of model behavior to develop generalized and more sophisticated representations of reactive behaviors and missions. ModSAF provides an open architecture that is expected to be the starting point for future extensions of SAFOR capabilities.

Object. A fundamental element of a conceptual representation that reflects the real-world at levels of abstraction and resolution appropriate for a simulation. For any given value of time, the state of an object is defined as the enumeration of all its attribute values.

Object-Based. A software design methodology adhering to only some of the properties of object oriented software; for example, Ada does not support inheritance, a key property of object oriented systems, therefore, Ada is often referred to as an object based language.

Object-Oriented. A software design methodology that, when applied to DIS, results in the battlefield being represented by objects, where objects encapsulate the methods or procedures associated with the object and where objects communicate with other objects by message passing. Examples of battlefield objects are platoons (unit level), tanks (platform level), main guns (component or module level), and gun barrels (part level). One of the main benefits of an object-oriented approach is the inherent modularity; e.g., to change a tank model, only the tank object must be changed.

Object-Oriented Language. A language that best suits an object-oriented decomposition of software and that provides the capability to implement classes and objects. Directly supports data abstraction and classes and provides additional support for inheritance as a means of expressing hierarchies of classes.

Object-Oriented Programming. Use of a programming system that results in programs organized as cooperative collections of objects, each of which represents an instance of some class and whose classes are members of class hierarchies as defined by the inheritance mechanism.

Open System. A system in which the components and their composition are specified in a non-proprietary environment, enabling competing organizations to use these standard components to build competitive systems. There are three perspectives on open systems: (1) portability -- the degree to which a system component can be used in various environments; (2) interoperability --

the ability of individual components to exchange information; and (3) integration -- the consistency of the various human-machine interfaces between an individual and all hardware and software in the system.

Protocol. A set of rules and formats (semantic and syntactic) that determine the communication behavior of simulation applications.

Prototype. A preliminary type, form, or instance of a system that serves as a model for later stages or for the final, complete version of the system.

Real-Time. In modeling and simulation, simulated time advances at the same rate as actual time; for example, running the simulation for one second results in the model advancing time by one second. Contrast with: fast time; slow time.

Real-Time System. A system that computes its results as quickly as they are needed by a real-world system. Such a system responds quickly enough that there is no perceptible delay to the human observer. In general use, the term is often perverted to mean within the patience and tolerance of a human user.

Real-World. The set of real or hypothetical causes and effects that simulation technology attempts to replicate. When used in a military context, the term is synonymous with real battlefield to include air, land, and sea combat. Synonym: real battlefield.

Resolution. The degree of detail and precision used in the representation of real-world aspects in a model or simulation. See: granularity.

Scalability. The ability of a distributed simulation to maintain time and spatial consistency as the number of entities and accompanying interactions increase.

Scenario. (1) Description of an exercise ("initial conditions" in military terms). It is part of the session database which configures the units and platforms and places them in specific locations with specific missions. (2) An initial set of conditions and timeline of significant events imposed on trainees or systems to achieve exercise objectives.

Simulation. A method for implementing a model over time.

Simulation Environment. (1) Consists of the operational environment surrounding the simulation entities including terrain, atmospheric, bathospheric, and cultural information. (2) All the conditions, circumstances, and influences surrounding and affecting simulation entities including those stated in (1).

Simulation Fidelity. Refers to the degree of similarity between the training situation and the operational situation that is being simulated.

Simulation Time. (1) A simulation's internal representation of time. Simulation time may accumulate faster, slower, or at the same pace as sidereal time. (2) The reference time (e.g., universal coordinated time) within a simulation exercise, this time is established ahead of time by the simulation management function and is common to all participants in a particular exercise.

Slow Time. The duration of activities within a simulation in which simulated time advances slower than actual time.

Standard. A rule, principle, or measurement established by authority, custom, or general consent as a representation or example.

Stimulate. To provide input to a system in order to observe or evaluate the system's response.

Synthetic Battlefield. One type of synthetic environment.

Synthetic Environments (SE). Internetted simulations that represent activities at a high level of realism from simulations of theaters of war to factories and manufacturing processes. These environments may be created within a single computer or a vast distributed network connected by local and wide area networks and augmented by super-realistic special effects and accurate behavioral models. They allow complete visualization of and total immersion into the environment being simulated.

System. A collection of components organized to accomplish a specific function or set of functions.

Technical Infrastructure. The internal framework that must be built to implement an operational service.

Time Step Models. Dynamic models in which time is advanced by a fixed or independently-determined amount to a new point in time, and the states or status of some or all resources are updated as of that new point in time. Typically these time steps are of constant size, but they need not be.

Unified Combatant Command (UCC). One of the unified combatant commands established by the President of the United States according to Title 10, United States Code. Also referred to as combatant commands. UCCs include: US Atlantic Command (abbreviated as USACOM); US Central Command (abbreviated as USCENTCOM); US European Command (abbreviated as USEUCOM); US Pacific Command (abbreviated as USPACOM); US Southern Command (abbreviated as USSOUTHCOM); US Space Command (abbreviated as USSPACECOM); US Special Operations Command (abbreviated as USSOCOM); US Strategic Command (abbreviated as USSTRATCOM); and, US Transportation Command (abbreviated as USTRANSCOM)).

Validation. The process of determining the extent to which a model or simulation is an accurate representation of the real-world from the perspective of the intended use(s) of the model or simulation.

Verification. The process of determining that model or simulation implementation accurately represents the developer's conceptual description and specification. Verification also evaluates the extent to which the model or simulation has been developed using sound and established software engineering techniques.

Virtual Modeling and Simulation. A synthetic representation of warfighting environments patterned after the simulated organization and operations of actual military units. Differences in the representation of the simulated battlefield (i.e., whether real-world, computer generated, or interactive players in simulators) are transparent to the participants who interact with their particular representation of the warfighting environment.

Warfare Simulation. A model of warfare or any part of warfare for any purpose (such as analysis or training).

12. Annex E -- Coordination

HQDA, Deputy Chief of Staff for Operations and Plans, DAMO-TR

Chief of Naval Operations, Director of Naval Training, N7, N096, DONMSMO

Deputy Chief of Staff, Air and Space Operations, HQ USAF/XO

Commandant of the Marine Corps, MCCDC

Commander in Chief, US Atlantic Command, Code J3, J5, J73

Commander in Chief, US Central Command, Code J3, J5

US Commander in Chief, US European Command, Code J3, J5

Commander in Chief, US Pacific Command, Code J35, J55

Commander in Chief, US Southern Command, Code J3, J5

Commander in Chief, US Space Command, Code J3, J5

Commander in Chief, US Special Operations Command, Code J3, J5, J5-C, J3-T

Commander in Chief, US Strategic Command, Code J3, J5

Commander in Chief, US Transportation Command, Code J3, J5

Commander in Chief, Combined Forces Command, Korea, Code J35, J5

Operational Plans and Interoperability Directorate, Joint Staff, J-7

Force Structure, Resources and Assessments Directorate, Joint Staff, J-8

Director, Defense Information Systems Agency

Director, Defense Intelligence Agency

Director, Defense Modeling and Simulation Office

Director, National Imagery and Mapping Agency

Deputy for C4I Modeling, Simulation and Assessment, Defense Information Systems Agency

Commander, US Air Force Combat Climatology Command

JSIMS Joint Program Office, Orlando, FL